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ABSTRACT

At the request of the National Science Foundation (NSF), the Higher Education Panel (a stratified sample of 760 colleges and universities) collected information on the level of institutional expenditures for research equipment, the federal contribution to those expenditures, and the share of funds expended for high-cost items. The data were intended to analyze the impact of federal funding on equipment expenditures and the probable effects of various policy alternatives. It was found that during FY 1978 approximately $280 million was spent at Ph.D.-granting institutions for the purchase of scientific research equipment. Half of this amount was used in the life sciences, 19 percent in engineering disciplines, and 16 percent in the physical sciences. The federal government financed 65 percent of equipment purchases made from current funds; that proportion was 59 percent at public institutions and 75 percent at private institutions. For all science fields, 9 percent of research equipment expenditures from current funds were for items costing $50,000 or more. In electrical and computer engineering and in chemistry, that proportion was approximately 27 percent. When comparing FY 1978 equipment expenditures with the average for the previous three years, nearly half of respondents indicated that expenditures from current funds were about the same; one-third indicated they were greater. Expenditures for separately budgeted scientific research equipment from current funds comprised about 6 percent of all research and development expenditures at doctorate-granting institutions in FY 1978. Data tables are included, as are the survey instrument and instructions. A list of disciplines in the various categories used is appended. Also appended are a response analysis and the stratification design. (MSE)

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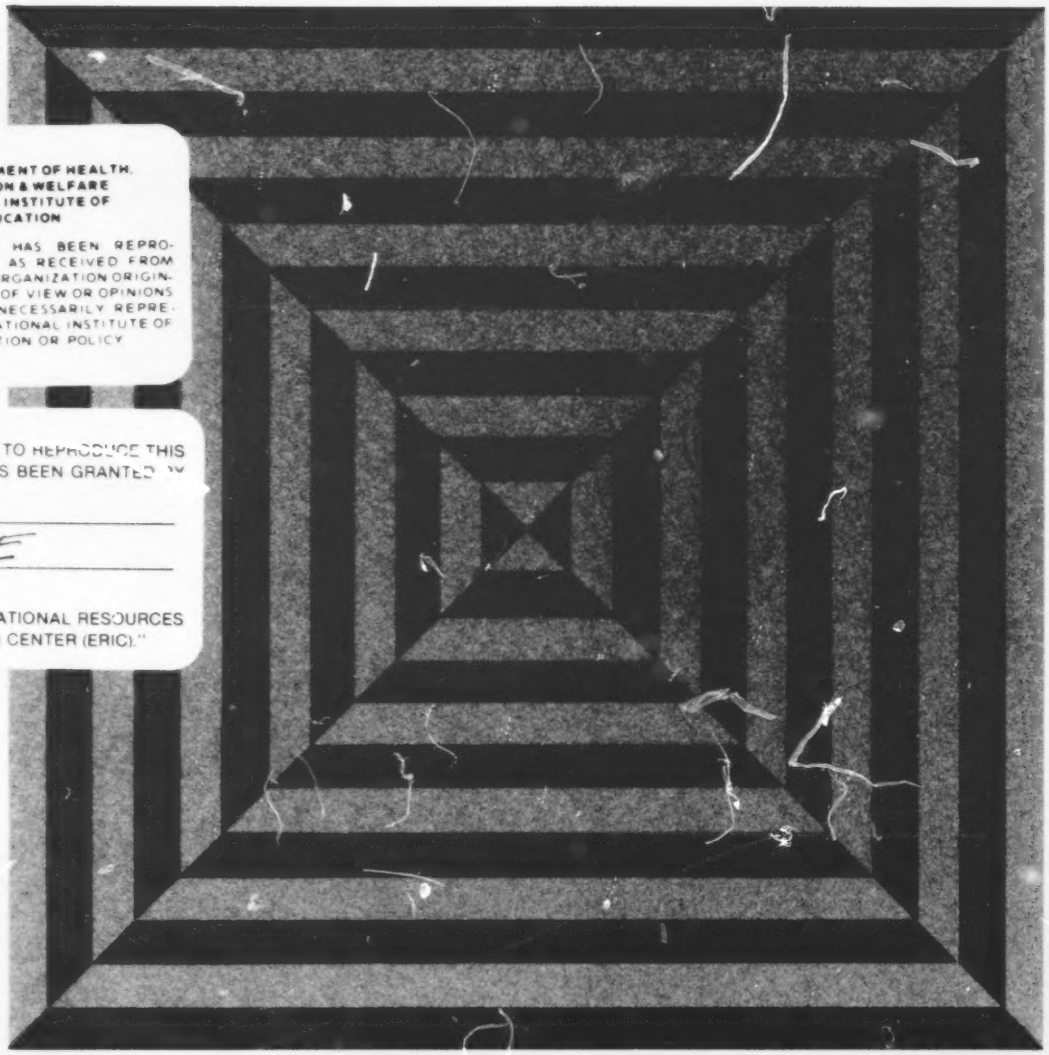
Expenditures for Scientific Research Equipment at Ph.D.-Granting Institutions, FY 1978

Irene L. Gomberg and Frank J. Atelsek



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J. W. Peltason, *President*

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The Higher Education Panel is a survey research program established by the Council for the purpose of securing policy-related information quickly from representative samples of colleges and universities. *Higher Education Panel Reports* are designed to expedite communication of the Panel's survey findings to policy-makers in government, in the associations, and in educational institutions across the nation.

The Higher Education Panel's surveys on behalf of the Federal Government are conducted under contract support provided jointly by the National Science Foundation, the National Endowment for the Humanities, and the U. S. Office of Education (NSF Contract SRS-78-16385).

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Expenditures for Scientific Research Equipment at Ph.D.-Granting Institutions, FY 1978

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Frank J. Atelsek

Higher Education Panel Reports

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Any opinions, findings, and conclusions or recommendations are those of the authors and do not necessarily reflect the views of the sponsoring agencies.

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The Federal Advisory Board and the HEP Advisory Committee guided the conduct of the survey, and the FAB's Technical Advisory Committee supplied valuable technical expertise.

As usual, we are indebted to our Panel representatives and survey respondents for their continued cooperation and good will.

Highlights

- During FY 1978, approximately $280 million was expended at Ph.D.-granting institutions for the purchase of scientific research equipment.
- Half of this amount was used in the life sciences, 19 percent in engineering disciplines, and 16 percent in the physical sciences.
- The federal government financed 65 percent of equipment purchases made from current funds; that proportion was 59 percent at public institutions and 75 percent at private institutions.
- For all science fields, 9 percent of research equipment expenditures from current funds were for items costing $50,000 or more. In electrical and computer engineering and in chemistry, that proportion was approximately 27 percent.
- When comparing FY 1978 equipment expenditures with the average for the previous three years, nearly half of respondents indicated that expenditures from current funds were about the same and one-third indicated they were greater.
- Expenditures for separately budgeted scientific research equipment from current funds comprised about 6 percent of all research and development expenditures at doctorate-granting institutions during FY 1978.

Background

Part of the mission of the National Science Foundation is to monitor the scientific research effort of the nation's universities and colleges, and a critical aspect of this effort is the availability and adequacy of scientific equipment.[1] In expression of a widely held belief that scientific progress has sometimes been impeded by outmoded instrumentation, a number of academic scientists and the ad hoc Committee on Instrument Funding have recently voiced the need for increasing the supply of new research equipment.

To help assess the situation, NSF asked the American Council on Education, through its Higher Education Panel, to collect information on the level of institutional expenditures for research equipment, the federal contribution to those expenditures, and the share of funds expended for high-cost items. These data will enable NSF to better analyze the impact of federal funding upon equipment expenditures and the probable effects of various policy alternatives.

Methods Summary

The Higher Education Panel is an ongoing survey research program created in 1971 by the American Council on Education to conduct specialized surveys on topics of current policy interest to the higher education community and to government agencies.

The Panel is a stratified sample of 760 colleges and universities drawn from the more than 3,000 institutions listed in the National Center for Education Statistics' Education Directory. All institutions in this population are grouped in terms of the variables constituting the Panel's stratification design, which is based primarily on type (university, four-year college, two-year college), control (public, private), and size (full-time equivalent enrollment). For any given survey either the entire Panel or an appropriate subset is used.

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[1] A recently published Higher Education Panel report (No. 44, Shared Use of Scientific Equipment at Colleges and Universities, Fall 1978, 1979) focused on the mechanisms planned or already in operation to facilitate the sharing of scientific equipment.

The population for this survey was limited to institutions which award the doctorate degree. The survey instrument (see Appendix A) was mailed on April 23, 1979, to the 236 colleges and universities in the Panel that met this criterion.

For fiscal year 1978, Panel institutions were asked to report, by field of science, the level of separately budgeted expenditures for scientific research equipment from current funds and from plant funds. Respondents were also asked to indicate the extent of federal support for equipment expenditures.

Separately budgeted research and development included all funds expended for activities specifically organized to produce research outcomes and either commissioned by an agency external to the institution or separately budgeted by an organizational unit within the institution. The survey was specifically limited in this way and therefore may exclude other substantial expenditures. For further definitions and instructions, please refer to Appendix A.

The questionnaire proved to be a very difficult one for the Panel members. Many indicated they could not distinguish research from instructional equipment, federal from nonfederal funding sources, or specific fields for which equipment was purchased. Other institutions were unable to retrieve the requested information without inordinate staff effort because of accounting procedures. As a result, extensive telephone and mail followup efforts were made. By the close of the field phase, usable data had been received from 159 institutions, or 67 percent of those surveyed. Data from responding institutions were statistically adjusted to represent the national population of 288 colleges and universities that award a Ph.D. degree.

Appendix B compares respondents with nonrespondents and describes the stratification design for weighting.

Findings

During fiscal 1978, an estimated $280 million was expended for scientific research

equipment at Ph.D.-granting institutions. See table 1.[2] Half of the expenditures were made in the life sciences, one-fifth in engineering, and one-sixth in physical sciences. Table A shows the distribution of dollars for all science fields.

On average, public institutions expended somewhat more for research equipment than private institutions. Public institutions accounted for 56 percent of the survey population but 64 percent of the expenditures for research equipment. Spending patterns by field of science were similar in both sectors. However, public institutions expended proportionately three times more in the environmental sciences and computer sciences than did private institutions, and private institutions expended proportionately more in engineering and the physical sciences than did public institutions.

Table A: Distribution of Funds Expended for Scientific Research Equipment, FY 1978

	Dollars (in 000's)	Percentage
Life sciences	137,783	49
Engineering	53,234	19
Physical sciences	44,438	16
Environmental sciences	16,805	6
Computer sciences	9,568	3
Other sciences	8,873	3
Social sciences	4,457	2
Psychology	4,194	1
Mathematics	541	*
Total	279,893	100

*Less than .05 percent.

Categories of Funding

Current funds represented $247 million, or almost 9 of every 10 dollars expended for research equipment. Plant funds provided the remaining $33 million.[3]

[2]Detailed report tables, identified by numerals, begin on page 8. Summary tables, identified by letters, appear throughout the text.

[3]As mentioned earlier, many surveyed institutions found the questionnaire difficult to complete, and many respondents were unable to provide all the data requested. Information regarding plant funds proved to be the most difficult to report and, consequently, had the lowest response rates.

Overall, at private institutions a slightly larger proportion of equipment purchases came from current funds: 92 percent, compared with 86 percent at public institutions. This difference held in all major fields except one. In the computer sciences, the proportions from current funds were nearly the same (84 percent in private and 85 percent in public institutions).

Current Funds Expenditures

The federal government provided significant support for equipment purchases from current funds. Two-thirds of these expenditures, amounting to more than $160 million, came from grants and contracts from various federal agencies. See table 2.

Federal support accounted for a considerably larger share of equipment purchases at private institutions than at public institutions: 75 percent compared with 59 percent. See table B below. This difference held for all of the major field groupings except the physical sciences, to which federal sources contributed 70 percent of the current funds used for equipment purchases in each sector. See tables 3 and 4.

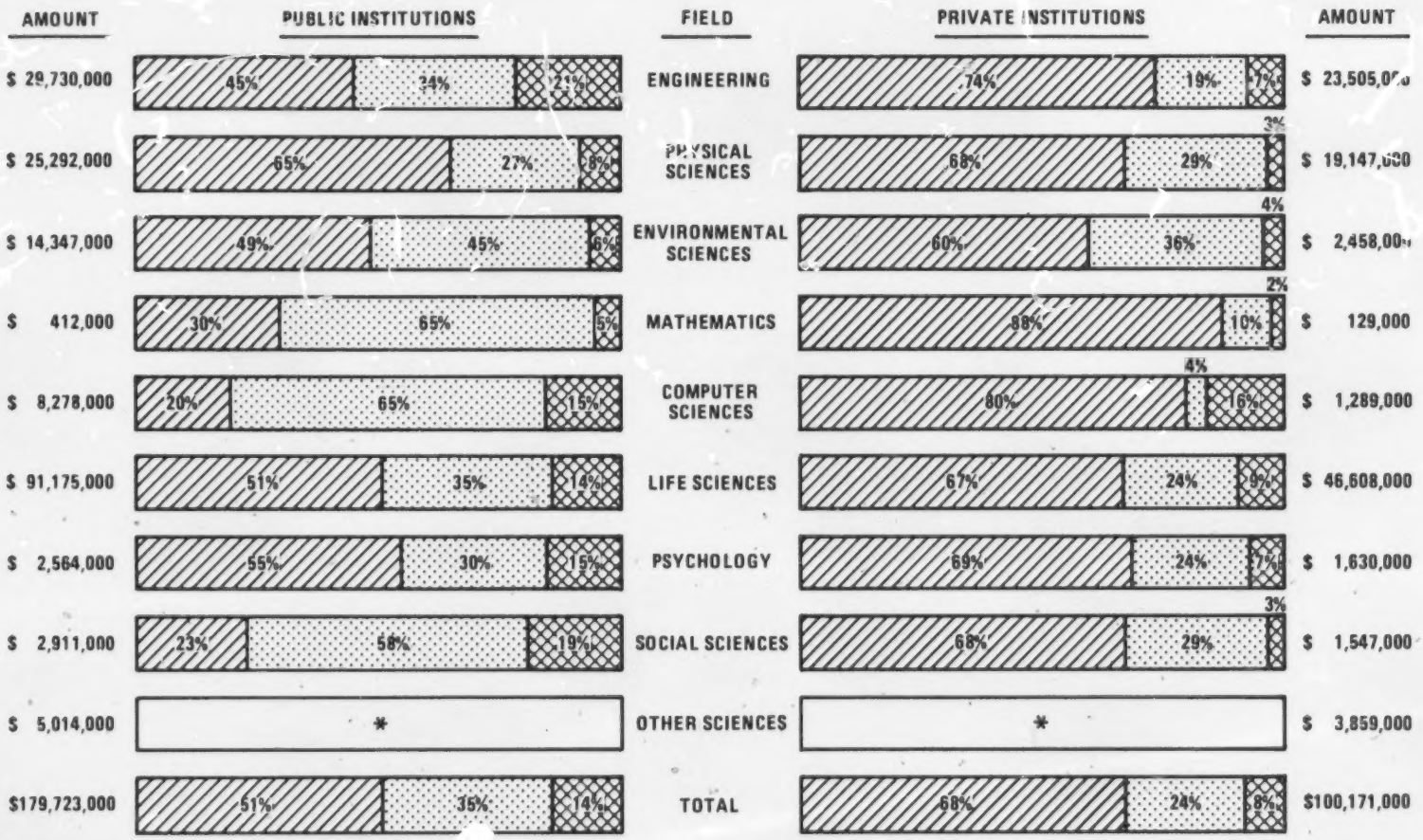
Table B: Proportion of Separately Budgeted Scientific Equipment Expenditures (Current Funds) Supported by the Federal Government, FY 1978

Category of Institution	Total Expenditures (Current Funds)	Percentage from the Federal Government
All	$247,228,000	65
Public	155,292,000	59
Private	91,936,000	75

In both sectors, the fields of chemical and civil engineering, geological sciences, and the social sciences each received lower-than-average proportions of federal support for equipment expenditures. Higher-than-average federal support was given in both sectors in the fields of mechanical engineering, atmospheric sciences, physics, and other physical sciences.

Figure 1 shows the distribution of the sources of research equipment expenditures, including both current and plant funds.

FIG. 1 SOURCES OF EXPENDITURES FOR SCIENTIFIC RESEARCH EQUIPMENT, F Y 1978



* NUMBER OF RESPONSES TOO LOW TO SHOW DETAIL

High-Cost Equipment

During the survey year, 9 percent of scientific equipment expenditures from current funds were made for items costing $50,000 or more. The fields of electrical and computer engineering and chemistry each directed more than one-fourth of their equipment dollars toward high-cost items.

Private institutions spent a somewhat larger proportion of their equipment funds for expensive items: 11 percent vs. 8 percent at public institutions.

Change in Level of Expenditures

Respondents were asked to compare their FY 78 equipment expenditures with the average for the preceding three years. As can be seen in table C below, their responses were mixed according to the category of funds.

Table C: FY 1978 Expenditures for Scientific Research Equipment Compared with the Average Expenditures for the Previous Three Years (unweighted data)

FY 78 Expenditures Compared with Average	Current Funds*			Plant Funds*		
	Total	Public	Private	Total	Public	Private
Greater	36	33	41	31	31	30
About the same (±5%)	46	46	45	43	41	50
Less	18	21	14	26	28	20
Total percent	100 (N=141)	100 (N=92)	100 (N=49)	100 (N=42)	100 (N=32)	100 (N=10)

*This distribution includes only those institutions that reported expenditures from this category of funds.

With both current and plant funds, the largest proportion of institutions--more than two-fifths--indicated that spending levels had remained stable, and about one-third felt there had been a greater level of expenditures in FY 78. Institutions more frequently noted lower levels of FY 78 expenditures from plant funds than from current funds (26 percent vs. 18 percent). By sector, proportionately more public than private institutions reported that their FY 78 expenditures were less from both current and from plant funds.

Share of Total R&D Expenditures

During FY 78, expenditures for separately budgeted scientific research equipment from current funds comprised about 6 percent of all research and development expenditures at doctorate-granting institutions. See table D. That proportion ranged from 9 percent in the physical sciences to 2 percent in the social sciences. Whereas the overall proportions were almost the same, public institutions spent a much larger share of R&D funds for research equipment than did private institutions in mathematical and computer sciences. The reverse was true in engineering: private institutions spent a larger proportion on research equipment in this field than did public institutions.

Table D: FY 78 Expenditures for Separately Budgeted Scientific Research Equipment from Current Funds as a Percentage of Total Research and Development Expenditures*

	Ph.D.-Granting Institutions		
	Total	Public	Private
Engineering	8	6	10
Physical sciences	9	8	9
Environmental sciences	4	5	3
Mathematical and computer sciences	7	10	3
Life sciences	5	5	5
Psychology	4	4	5
Social sciences	2	1	2
Other sciences	7	5	13
Total	6	5	6

*See tables 5, 6, and 7 for more detail.

Basic Report Tables

Table 1

Distribution of Expenditures for Scientific Research Equipment, by Category of Funds, FY 1978

Field	Total Dollars	Total Percent	Current Funds	Plant Funds
All Ph.D.-Granting Institutions				
Engineering	53,234,000	100	85	15
Physical sciences	44,438,000	100	94	6
Environmental sciences	16,805,000	100	94	6
Mathematics	541,000	100	96	4
Computer sciences	9,568,000	100	85	15
Life sciences	137,783,000	100	88	12
Psychology	4,194,000	100	88	12
Social sciences	4,457,000	100	87	13
Other sciences	8,873,000	100	*	*
Total	279,893,000	100	88	12
Public Ph.D.-Granting Institutions				
Engineering	29,730,000	100	79	21
Physical sciences	25,292,000	100	92	8
Environmental sciences	14,347,000	100	94	6
Mathematics	412,000	100	95	5
Computer sciences	8,278,000	100	85	15
Life sciences	91,175,000	100	86	14
Psychology	2,564,000	100	85	15
Social sciences	2,911,000	100	81	19
Other sciences	5,014,000	100	*	*
Total	179,723,000	100	86	14
Private Ph.D.-Granting Institutions				
Engineering	23,505,000	100	93	7
Physical sciences	19,147,000	100	97	3
Environmental sciences	2,458,000	100	96	4
Mathematics	129,000	100	98	2
Computer sciences	1,289,000	100	84	16
Life sciences	46,608,000	100	91	9
Psychology	1,630,000	100	93	7
Social sciences	1,547,000	100	97	3
Other sciences	3,859,000	100	*	*
Total	100,171,000	100	92	8

Note: On this and subsequent tables, subtotals may not add exactly to their corresponding totals because of weighting and rounding.

*The number of responding institutions is too small to show detail.

Table 2

Distribution of Expenditures for Scientific Research Equipment from Separately Budgeted Research and Development Funds (Current Funds Only), by Source and Field, FY 1978: All Ph.D.-Granting Institutions

Field	Source: Total Dollars	Source: Total Percent	Source: Federal Government	Source: All Other	Equipment Costing $50,000 or More[a]
Engineering					
Chemical	3,852,000	100	56	44	0
Civil	2,575,000	100	40	60	0
Electrical & computer	13,080,000	100	73	27	28
Mechanical	4,480,000	100	87	13	6
Other	21,255,000	100	69	31	6
Subtotal	45,243,000	100	68	32	12
Physical sciences					
Astronomy	4,027,000	100	75	25	0
Chemistry	21,484,000	100	62	38	27
Physics	14,310,000	100	81	19	5
Other	2,011,000	100	76	24	0
Subtotal	41,832,000	100	70	30	15
Environmental sciences					
Atmospheric	3,525,000	100	78	22	15
Geological	8,046,000	100	33	67	4
Oceanographic	4,216,000	100	67	33	0
Subtotal	15,788,000	100	54	46	5
Mathematics	518,000	100	46	54	0
Computer sciences	8,099,000	100	33	67	11
Life sciences					
Biological	41,696,000	100	72	28	4
Agricultural	17,337,000	100	33	67	1
Medical	56,408,000	100	69	31	9
Other	5,272,000	100	64	36	16
Subtotal	120,713,000	100	65	35	6
Psychology	3,690,000	100	69	31	0
Social sciences	3,860,000	100	44	56	16
Other sciences	7,485,000	100	b	b	7
Total	$247,228,000	100	65	35	9

[a] Caution should be exercised in interpreting these data. In many of the fields only one or two institutions purchased high-cost equipment, which may create an instability in the percentages shown.

[b] The number of responding institutions is too small to show detail.

Table 3

Distribution of Expenditures for Scientific Research Equipment from Separately Budgeted Research and Development Funds (Current Funds Only), by Source and Field, FY 1978: Public Ph.D.-Granting Institutions

Field	Source: Total Dollars	Source: Total Percent	Source: Federal Government	Source: All Other	Equipment Costing $50,000 or More[a]
Engineering					
Chemical	2,091,000	100	57	43	0
Civil	2,162,000	100	35	65	0
Electrical & computer	5,686,000	100	57	43	19
Mechanical	1,762,000	100	99	1	0
Other	11,795,000	100	56	44	9
Subtotal	23,497,000	100	57	43	9
Physical sciences					
Astronomy	2,496,000	100	92	8	0
Chemistry	11,733,000	100	63	37	28
Physics	7,324,000	100	74	26	7
Other	1,773,000	100	74	26	0
Subtotal	23,326,000	100	70	30	16
Environmental sciences					
Atmospheric	3,329,000	100	77	23	16
Geological	6,820,000	100	30	70	5
Oceanographic	3,276,000	100	67	33	0
Subtotal	13,425,000	100	52	48	6
Mathematics	392,000	100	32	68	0
Computer sciences	7,012,000	100	24	76	12
Life sciences					
Biological	25,375,000	100	70	30	3
Agricultural	17,309,000	100	33	67	1
Medical	32,738,000	100	65	35	8
Other	2,898,000	100	62	38	3
Subtotal	78,319,000	100	60	40	5
Psychology	2,176,000	100	65	35	0
Social sciences	2,352,000	100	28	72	0
Other sciences	4,792,000	100	b	b	10
Total	155,292,000	100	59	41	8

[a]Caution should be exercised in interpreting these data. In many of the fields only one or two institutions purchased high-cost equipment, which may create an instability in the percentages shown.

[b]The number of responding institutions is too small to show detail.

Table 4

Distribution of Expenditures for Scientific Research Equipment from Separately Budgeted Research and Development Funds (Current Funds Only), by Source and Field, FY 1978: Private Ph.D.-Granting Institutions

Field	Source: Total Dollars	Source: Total Percent	Source: Federal Government	Source: All Other	Equipment Costing $50,000 or More[a]
Engineering					
Chemical	1,761,000	100	54	46	0
Civil	413,000	100	62	38	0
Electrical & computer	7,394,000	100	83	17	33
Mechanical	2,718,000	100	80	20	10
Other	9,460,000	100	82	18	3
Subtotal	21,746,000	100	80	20	15
Physical sciences					
Astronomy	1,531,000	100	47	53	0
Chemistry	9,751,000	100	60	40	26
Physics	6,986,000	100	89	11	3
Other	238,000	100	91	9	0
Subtotal	18,506,000	100	70	30	15
Environmental sciences					
Atmospheric	196,000	100	98	2	0
Geological	1,226,000	100	50	50	0
Oceanographic	940,000	100	69	31	0
Subtotal	2,363,000	100	62	38	0
Mathematics	127,000	100	90	10	0
Computer sciences	1,086,000	100	95	5	0
Life sciences					
Biological	16,321,000	100	74	26	5
Agricultural	28,000	100	88	12	0
Medical	23,670,000	100	74	26	9
Other	2,374,000	100	67	33	32
Subtotal	42,394,000	100	74	26	8
Psychology	1,514,000	100	74	26	0
Social sciences	1,507,000	100	70	30	41
Other sciences	2,693,000	100	b	b	0
Total	91,936,000	100	75	25	11

[a]Caution should be exercised in interpreting these data. In many of the fields only one or two institutions purchased high-cost equipment, which may create an instability in the percentages shown.

[b]The number of responding institutions is too small to show detail.

Table 5

FY 1978 Expenditures for Scientific Research Equipment from Separately-Budgeted Research and Development Funds (Current Funds Only) As a Proportion of Total and Federally Financed Research and Development Expenditures, by Field and Source: All Doctorate-Granting Institutions

Field	All Sources All Purposes[a]		Scientific Research Equipment Purchased from Separately-Budgeted R&D Funds				Federal Sources All Purposes[a]		Scientific Research Equipment Purchased from Separately-Budgeted Federal R&D Funds	
			All Equipment		Equipment > $50,000					
	Dollars (in 000s)	Percent	Dollars (in 000s)	Percent	Dollars (in 000s)	Percent	Dollars (in 000s)	Percent	Dollars (in 000s)	Percent
Engineering	592,013	100.0	45,243	7.6	5,298	.9	402,206	100.0	30,775	7.7
Physical sciences	481,906	100.0	41,832	8.7	6,467	1.3	384,072	100.0	29,444	7.7
Environmental sciences	366,333	100.0	15,788	4.3	841	.2	267,219	100.0	8,461	3.2
Mathematical and computer sciences	119,706	100.0	8,617	7.2	860	.7	83,261	100.0	2,927	3.5
Life sciences	2,512,917	100.0	120,713	4.8	7,519	.3	1,606,269	100.0	77,950	4.9
Psychology	86,192	100.0	3,690	4.3	0	0	61,935	100.0	2,534	4.1
Social sciences	261,782	100.0	3,860	1.5	611	.2	135,309	100.0	1,706	1.3
Other sciences	109,263	100.0	7,485	6.9	493	.5	62,806	100.0	7,044	11.2
Total	4,530,112	100.0	247,228	5.5	22,089	.5	3,003,077	100.0	160,840	5.4

[a]From NSF Survey of Scientific and Engineering Expenditures at Universities and Colleges, FY 1978 (prepublication tables).

Table 6

FY 1978 Expenditures for Scientific Research Equipment from Separately-Budgeted Research and Development Funds (Current Funds Only) As a Proportion of Total and Federally Financed Research and Development Expenditures, by Field and Source: Public Doctorate-Granting Institutions

Field	All Sources All Purposes[a]		Scientific Research Equipment Purchased from Separately-Budgeted R&D Funds				Federal Sources All Purposes[a]		Scientific Research Equipment Purchased from Separately-Budgeted Federal R&D Funds	
			All Equipment		Equipment > $50,000					
	Dollars (in 000s)	Percent	Dollars (in 000s)	Percent	Dollars (in 000s)	Percent	Dollars (in 000s)	Percent	Dollars (in 000s)	Percent
Engineering	367,379	100.0	23,497	6.4	2,070	.6	230,210	100.0	13,409	5.8
Physical sciences	274,074	100.0	23,326	8.5	3,767	1.4	208,278	100.0	16,444	7.9
Environmental sciences	277,451	100.0	13,425	4.8	841	.3	192,613	100.0	6,991	3.6
Mathematical and computer sciences	72,288	100.0	7,404	10.2	860	1.2	42,588	100.0	1,776	4.2
Life sciences	1,618,613	100.0	78,319	4.8	3,925	.2	930,186	100.0	46,630	5.0
Psychology	55,158	100.0	2,176	3.9	0	0	38,659	100.0	1,410	3.6
Social sciences	17[illegible],937	100.0	2,352	1.3	0	0	87,385	100.0	653	.7
Other sciences	8[illegible],123	100.0	4,792	5.4	493	.6	49,318	100.0	5,035	10.2
Total	2,932,023	100.0	155,292	5.3	11,957	.4	1,779,237	100.0	92,346	5.2

[a]From NSF Survey of Scientific and Engineering Expenditures at Universities and Colleges, FY 1978 (prepublication tables).

Table 7

FY 1978 Expenditures for Scientific Research Equipment from Separately-Budgeted Research and Development Funds (Current Funds Only) As a Proportion of Total and Federally Financed Research and Development Expenditures, by Field and Source:
Private Doctorate-Granting Institutions

Field	All Sources All Purposes[a]		Scientific Research Equipment Purchased from Separately-Budgeted R&D Funds				Federal Sources All Purposes[a]		Scientific Research Equipment Purchased from Separately-Budgeted Federal R&D Funds	
			All Equipment		Equipment > $50,000					
	Dollars (in 000s)	Percent	Dollars (in 000s)	Percent	Dollars (in 000s)	Percent	Dollars (in 000s)	Percent	Dollars (in 000s)	Percent
Engineering	224,634	100.0	21,746	9.7	3,228	1.4	171,996	100.0	17,366	10.1
Physical sciences	207,832	100.0	18,506	8.9	2,700	1.3	175,794	100.0	13,000	7.4
Environmental sciences	88,882	100.0	2,363	2.7	0	0	74,606	100.0	1,470	2.0
Mathematical and computer sciences	47,418	100.0	1,213	2.6	0	0	40,673	100.0	1,151	2.8
Life sciences	894,304	100.0	42,394	4.7	3,594	.4	676,083	100.0	31,320	4.6
Psychology	31,034	100.0	1,514	4.9	0	0	23,276	100.0	1,124	4.8
Social sciences	83,845	100.0	1,507	1.8	611	.7	47,924	100.0	1,053	2.2
Other sciences	20,140	100.0	2,693	13.4	0	0	13,488	100.0	2,009	14.9
Total	1,598,089	100.0	91,936	5.8	10,132	.6	1,223,840	100.0	68,494	5.6

[a]From NSF Survey of Scientific and Engineering Expenditures at Universities and Colleges, FY 1978 (prepublication tables).

APPENDIX A: Survey Instrument

AMERICAN COUNCIL ON EDUCATION
ONE DUPONT CIRCLE
WASHINGTON, D. C. 20036

HIGHER EDUCATION PANEL
(202) 833-4757

April 23, 1979

Dear Higher Education Panel Representative:

Attached is the forty-seventh survey of the Higher Education Panel, "Expenditures for Scientific Research Equipment, Fiscal Year 1978." It is sponsored by the National Science Foundation, which seeks information on expenditures from *separately budgeted* research and development funds for the purchase of equipment used primarily for scientific research.

The survey addresses the overall policy issue of the adequacy of scientific research equipment. As such it is closely allied with an earlier NSF-sponsored study on the shared use of scientific equipment (HEP survey #44). The present survey is designed to obtain data on the level of university expenditures for research equipment, the federal contribution to these expenditures, and the proportion of funds expended for high-cost equipment. With this information NSF and other federal science agencies will be better able to determine the probable effects of federal policy alternatives.

Based on the field test results, we believe that the requested information can be provided from central institutional sources. Please provide your best estimates where actual data are either not available or not easily accessible. The field test also indicated that directors of institutional research and vice-presidents for research would be best able to respond. As usual, however, we leave that judgment to you.

Please understand that responses from your institutions will be held in strictest confidence. As with all our surveys, the data you provide will be reported in summary fashion only and will not be identifiable with your institution. This survey is authorized by the National Science Foundation Act of 1950, as amended. While you are not required to respond, your cooperation is needed to make the results comprehensive, reliable, and timely.

Please return the completed questionnaire to us by May 14, 1979. A prepaid return envelope has been enclosed for your convenience. If you have any problems or questions, please do not hesitate to telephone us collect at 202-833-4757.

Thank you for your continuing support.

Sincerely,

Frank J. Atelsek

Frank J. Atelsek
Panel Director

Instructions

This survey requests fiscal year 1978 expenditures from separately budgeted research and development funds for purchase of scientific equipment to be used primarily for research. *Exclude equipment used primarily for instruction.*

If actual expenditure data are not easily available, please provide your best estimates.

Equipment is defined to include articles of nonexpendable tangible personal property having a useful life of more than one year and an acquisition cost of *$300 or more* per unit. Institutions may use their own definition provided that it at least includes all equipment defined here.

The equipment may be of the following types provided it is purchased from separately budgeted research and development funds:

(a) movable scientific equipment, such as oscilloscopes, pulse-height analyzers

(b) fixed scientific equipment, such as electron microscopes

Separately budgeted research and development includes all funds expended for activities specifically organized to produce research outcomes and either commissioned by an agency external to the institution or separately budgeted by an organizational unit within the institution. (We realize that limiting the survey to expenditures from separately budgeted research and development funds may exclude other substantial expenditures. But *please* follow this limitation.)

In question #1:

For column (1) report current funds expenditures from all sources: federal government; state, county, municipal, or other governments and their agencies (including state funds supporting research and development at agricultural experiment stations); industry, private foundations and voluntary health agencies, individuals and associations; and institutional funds.

For column (2), federal government sources include funds from grants and contracts for research and development by all agencies of the federal government.

For column (3), include only funds which were expended for items of scientific research equipment which cost $50,000 or more. These expenditures may have come from any one or more sources and should also be included in column (1).

In question #2, expenditures from *plant funds only* should be reported. If you have expenditures for scientific research equipment from plant funds but are unable to determine the amount, please provide an estimate of the total.

American Council on Education
Higher Education Panel Survey No. 47

OMB No. 099-R0265
Exp. 6/81

Expenditures for Scientific Research Equipment

1. Please report below FY 1978 expenditures for scientific research equipment* purchased with *separately budgeted* research and development funds. Include expenditures from *current funds only*.

Discipline	Source of Funds: Total (1)	Source of Funds: Federal Government (2)	Of the total in (1), how much was for equipment costing $50,000 or more per unit (3)
Engineering			
Chemical	$	$	$
Civil			
Electrical and computer			
Mechanical			
Other (including multidisciplinary)			
Physical sciences			
Astronomy			
Chemistry			
Physics			
Other (including multidisciplinary)			
Environmental sciences			
Atmospheric			
Geological			
Oceanographic			
Mathematics			
Computer sciences			
Life sciences			
Biological			
Agricultural			
Medical			
Other (including multidisciplinary)			
Psychology			
Social sciences			
Other sciences not elsewhere classified			
TOTAL	$	$	$

Equipment is defined to include articles of nonexpendable tangible personal property having a useful life of more than one year and an acquisition cost of $300 or more per unit. Institutions may use their own definition provided that it at least includes all equipment defined here.

OVER

2. Please report FY 1978 expenditures for scientific research equipment purchased from *plant funds* from all sources:

Discipline	Amount
Engineering	
Physical sciences	
Environmental sciences	
Mathematics	
Computer sciences	
Life sciences	
Psychology	
Social sciences	
Other sciences	
Total	

3. How do the FY 1978 expenditures compare with the average for the previous three years? (Please check one in each column.)

FY 1978 Expenditures	Current Funds (Q.1)	Plant Funds (Q.2)
Substantially greater	( )	( )
Moderately greater (5% to 25% more)	( )	( )
About the same (within ±5%)	( )	( )
Moderately less (5% to 25% less)	( )	( )
Substantially less	( )	( )

4. IF YOUR INSTITUTION'S DEFINITION OF EQUIPMENT DIFFERS FROM THAT USED IN THIS SURVEY, what is the lowest dollar amount used for classification as equipment?

$_____

5. On what basis were the above expenditure data reported? (Please check one in each column.)

	Current Funds (Q.1)	Plant Funds (Q.2)
Actual records	( )	( )
Good estimates based substantially on actual records	( )	( )
Mostly estimates	( )	( )

6. If NSF were to periodically request these expenditure data, could your institution report good usable data?

	Current Funds (Q.1)	Plant Funds (Q.2)
Yes	( )	( )
No	( )	( )

If "no", what are the problems?

_____

_____

_____

_____

_____

Thank you for your assistance.

Please return this form by May 14, 1979 to:

Higher Education Panel
American Council on Education
One Dupont Circle, N.W.
Washington, D.C. 20036

Please keep a copy of this survey for your records.

Person completing form

Name_____

Dept._____

Phone_____

If you have any questions or problems, please call the HEP staff collect at (202)833-4757.

Illustrative Disciplines

Expenditures should be reported by discipline according to the following illustrative list. Based on field test findings, we expect that most respondents will report on the basis of departmental structures. Please use your best judgment in reporting data for science departments that cross over the discipline categories used in this survey.

Engineering
- Chemical
- Civil
- Electrical and computer
- Mechanical
- Other: aeronautical, agricultural, architectural, industrial, metallurgical, mining, nuclear, bio- and biomedical, textile, petroleum, energy

Physical sciences
- Astronomy: astrophysics, optical and radio, x-ray, gamma-ray, neutrino
- Chemistry: inorganic, organo-metallic, organic, physical, analytical, pharmaceutical, polymer science (excluding biochemistry)
- Physics: acoustics, atomic and molecular, condensed matter, elementary particles, nuclear structure, optics, plasma
- Other: Used for multidisciplinary projects within physical science and for disciplines not requested separately.

Environmental sciences
- Atmospheric: aeronomy, solar weather modification, meteorology, extraterrestrial atmospheres
- Geological: engineering geophysics, geology, geodesy, geomagnetism, hydrology, geochemistry, paleomagnetism, paleontology, physical geography, cartography, seismology, soil sciences
- Oceanographic: chemical, geological, physical, marine geophysics, marine biology, biological oceanography

Mathematics: algebra, analysis, applied mathematics, foundations and logic, geometry, numerical analysis, statistics, topology

Computer sciences: design, development, and application of computer capabilities to data storage and manipulation, information science

Life sciences
- Biological: anatomy, biochemistry, biophysics, biogeography, ecology, embryology, entomology, genetics, immunology, microbiology, nutrition, parasitology, pathology, pharmacology, physical anthropology, physiology, botany, zoology
- Agricultural: agricultural chemistry, agronomy, animal science, conservation, dairy science, plant science, range science, wildlife
- Medical: anesthesiology, cardiology, endocrinology, gastroenterology, hematology, neurology, obstetrics, opthalmology, preventive medicine and community health, psychiatry, radiology, surgery, veterinary medicine, dentistry, pharmacy
- Other: Used for multidisciplinary projects within life sciences.

Psychology: animal behavior, clinical, educational, experimental, human development and personality, social

Social sciences
- Economics: econometrics, international, industrial, labor, agricultural, public finance and fiscal policy
- Political science: regional studies, comparative government, international relations, legal systems, political theory, public administration.
- Sociology: comparative and historical, complex organizations, culture and social structure, demography, group interactions, social problems and welfare, theory
- Other: history of science, anthropology, linguistics, socio-economic geography

Other sciences not elsewhere classified: To be used when the multidisciplinary and interdisciplinary aspects make the classification under one primary field impossible.

APPENDIX B: Response Analysis and Stratification Design

Of the 236 Ph.D.-granting Panel members included in the survey, 159 institutions (67 percent) provided usable responses. As shown in table B-1, respondents generally resembled nonrespondents. Private four-year colleges were least likely to respond (only 56 percent did so), whereas public four-year colleges were most likely to respond (a 76 percent response rate).

Table B-1: Comparison of Respondents and Nonrespondents (In Percentages)

Characteristic	Respondents (N=159)	Nonrespondents (N=77)	Response Rate
Total	100.0	100.0	67.4
Control			
Public	64.2	59.7	68.9
Private	35.8	40.3	64.8
Type			
Public universities	45.9	48.1	66.4
Private universities	29.6	29.9	67.1
Public four-year colleges	18.2	11.7	76.3*
Private four-year colleges	6.3	10.4	55.6*
Total enrollment (1976)			
Less than 1,000	4.4	3.9	70.0
1,001-4,999	15.7	18.2	64.1
5,000-9,999	22.6	29.9	61.0
10,000 or more	57.2	48.1	71.1
Graduate enrollment (1976 FTE)			
200 or less	10.7	10.4	68.0
201-1,000	32.1	27.3	70.8
1,001-3,000	39.6	45.5	64.3
More than 3,000	17.6	16.9	68.3
Census region			
East	28.5	26.0	69.2
Midwest	20.9	26.0	62.3
South	32.9	29.9	69.3
West	17.7	18.2	66.7

*Exceeds or falls short of the overall response rate by more than 10 percent.

Source of Reported Data

Respondents were asked to indicate on what basis they had reported the current fund and plant fund expenditure data. On the whole, most responses came from actual records or good estimates based on actual records. As shown in table B-2 below, only 5 percent reported "mostly estimates" of current funds, and 12 percent reported "mostly estimates" of plant funds.

Table B-2: Source of Reported FY 78 Expenditures for Scientific Research Equipment (in percentages)

Source of Data	Current Funds			Plant Funds		
	Total	Public	Private	Total	Public	Private
Actual records	63.4	62.0	66.0	51.5	50.7	53.8
Good estimates based on actual records	31.4	32.0	30.2	36.1	35.2	38.5
Mostly estimates	5.2	6.0	3.8	12.4	14.1	7.7
Total	100.0 (N=153)	100.0 (N=100)	100.0 (N=53)	100.0 (N=97)	100.0 (N=71)	100.0 (N=26)

Weighting

The survey population was limited to the 288 colleges and universities that award the Ph.D. degree. Of these, 236 institutions are Panel members and were surveyed. All institutions in the population were grouped according to the variables constituting the stratification design as shown in table B-3.

Table B-3: Stratification Design for Weighting

Cell	Population (N=288)	Respondents (N=159)
1 Public Ph.D. universities	112	74
2 Private Ph.D. universities	73	46
3 Public medical school	17	11
4 Public nonblack four-year colleges (FTE > 8,750)	19	14
5 Private medical schools	8	4
6 Private nonblack four-year colleges (FTE > 8,750)	6	2
7 Public four-year colleges (FTE 3,700-8,750)	8	3
8 Public four-year colleges (FTE < 3,700)	6	1
9 Private four-year colleges (FTE 2,000-8,750)	10	2
10 Private four-year colleges (FTE 1,000-2,000)	9	1
11 Private four-year colleges (FTE < 1,000)	20	1

Statistical adjustment of the survey responses to develop national estimates was accomplished on an institutional basis. That is, each data item was weighted, within each stratification cell, by the ratio of the number of institutions in the population to the number of institutions in the Panel that responded to the survey item. Weights were computed separately to allow for a different number of responses to each part of the questionnaire. The resulting cell and item weights were applied to the responses of each institution, and the weighted data were then aggregated into the broad institutional categories used in the survey analysis. Thus all data represent independently computed population estimates, and subtotals may not add exactly to their corresponding totals.

Sampling Error

Because of the nature of both the Panel and the survey sample, no estimates of sampling error were computed. The population of institutions is stratified into 18 cells. The first eight, termed "certainty" cells, are self representing: All were invited to participate in the Panel during its revision in 1976. For each of the remaining ten cells, probability samples of institutions were drawn.

For this particular survey, the population was limited to 288 Ph.D.-granting institutions, 82 percent of which are Panel members. Further, 96 percent of the Ph.D.-granting institutions within the Panel are in the certainty cells; only ten institutions are in probability cells. Therefore, the computation of sampling error for ten institutions was not considered necessary.

Other Reports of the Higher Education Panel
American Council on Education

El-Khawas, E. H. and Kinzer, J. L. **The Impact of Office of Education Student Assistance Programs, Fall 1973.** Higher Education Panel Report, No. 18, April, 1974.

El-Khawas, E. H. and Kinzer, J. L. **Enrollment of Minority Graduate Students at Ph.D. Granting Institutions.** Higher Education Panel Report, No. 19, August, 1974.

El-Khawas, E. H. **College and University Facilities: Expectations of Space and Maintenance Needs for Fall 1974.** Higher Education Panel Report, No. 20, September, 1974.

Kinzer, J. L. and El-Khawas, E. H. **Compensation Practices for Graduate Research Assistants: A Survey of Selected Doctoral Institutions.** Higher Education Panel Report, No. 21, October, 1974.

El-Khawas, E. H. and Furniss, W. T. **Faculty Tenure and Contract Systems: 1972 and 1974.** Higher Education Panel Report, No. 22, December, 1974.

El-Khawas, E. H. and Kinzer, J. L. **A Survey of Continuing Education Opportunities Available to Nonacademic Scientists, Engineers and Mathematicians,** Higher Education Panel Report, No. 23, April, 1975.

Atelsek, Frank J. and Gomberg, Irene L. **Bachelor's Degrees Awarded to Minority Students, 1973-74.** Higher Education Panel Report, No. 24, January, 1977.

Atelsek, Frank J. and Gomberg, Irene L. **Nonfederal Funding of Biomedical Research and Development: A Survey of Doctoral Institutions.** Higher Education Panel Report, No. 25, July, 1975.

Gomberg, Irene L. and Atelsek, Frank J. **Major Field Enrollment of Junior-Year Students, 1973 and 1974.** Higher Education Panel Report, No. 26, April, 1976.

Atelsek, Frank J. and Gomberg, Irene L. **Student Assistance: Participants and Programs, 1974-75.** Higher Education Panel Report, No. 27, July, 1975.

Atelsek, Frank J. and Gomberg, Irene L. **Health Research Facilities: A Survey of Doctorate-Granting Institutions.** Higher Education Panel Report, No. 28, February, 1976.

Atelsek, Frank J. and Gomberg, Irene L. **Faculty Research: Level of Activity and Choice of Area.** Higher Education Panel Report, No. 29, January, 1976.

Atelsek, Frank J. and Gomberg, Irene L. **Young Doctorate Faculty in Selected Science and Engineering Departments, 1975 to 1980.** Higher Education Panel Report, No. 30, August, 1976.

Atelsek, Frank J. and Gomberg, Irene L. **Energy Costs and Energy Conservation Programs in Colleges and Universities: 1972-73 and 1974-75.** Higher Education Panel Report, No. 31, April, 1977.

Atelsek, Frank J. and Gomberg, Irene L. **Foreign Area Research Support Within Organized Research Centers at Selected Universities, FY 1972 and 1976.** Higher Education Panel Report, No. 32, December, 1976.

Atelsek, Frank J. and Gomberg, Irene L. **College and University Services for Older Adults.** Higher Education Panel Report, No. 33, February, 1977.

Atelsek, Frank J. and Gomberg, Irene L. **Production of Doctorates in the Biosciences, 1975-1980: An Experimental Forecast.** Higher Education Panel Report, No. 34, November 1977.

Gomberg, Irene L. and Atelsek, Frank J. **Composition of College and University Governing Boards.** Higher Education Panel Report, No. 35, August, 1977.

Atelsek, Frank J. and Gomberg, Irene L. **Estimated Number of Student Aid Recipients, 1976-77.** Higher Education Panel Report, No. 36, September, 1977.

Gomberg, Irene L. and Atelsek, Frank J. **International Scientific Activities at Selected Institutions, 1975-76 and 1976-77,** Higher Education Panel Report, No. 37, January, 1978.

Atelsek, Frank J. and Gomberg, Irene L. **New Full-Time Faculty 1976-77: Hiring Patterns by Field and Educational Attainment,** Higher Education Panel Report, No. 38, March 1978.

Gomberg, Irene L. and Atelsek, Frank J. **Nontenure-Track Science Personnel: Opportunities for Independent Research,** Higher Education Panel Report, No. 39, September 1978.

Atelsek, Frank J. and Gomberg, Irene L. **Scientific and Technical Cooperation with Developing Countries, 1977-78,** Higher Education Panel Report, No. 40, August 1978.

Atelsek, Frank J. and Gomberg, Irene L. **Special Programs for Female and Minority Graduate Students,** Higher Education Panel Report, No. 41, November 1978.

Gomberg, Irene L. and Atelsek, Frank J. **The Institutional Share of Undergraduate Financial Assistance, 1976-77,** Higher Education Panel Report, No. 42, May 1979.

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Atelsek, Frank J. and Gomberg, Irene L. **Shared Use of Scientific Equipment at Colleges and Universities, Fall 1978,** Higher Education Panel Report, No. 44, November 1979.

Gomberg, Irene L. and Atelsek, Frank J. **Newly Qualified Elementary and Secondary School Teachers, 1977-78 and 1978-79,** Higher Education Panel Report, No. 45, February 1980.

Atelsek, Frank J. and Gomberg, Irene L. **Refund Policies and Practices of Colleges and Universities.** Higher Education Panel Report, No. 46, February 1980.

Single copies of the above reports may be obtained from the Higher Education Panel, American Council on Education, One Dupont Circle, Washington, D. C. 20036.